THE

HAWAIIAN

PLANTERS' RECORD

VOL. XX JUNE, 1919 No. 6

A monthly paper devoted to the sugar interests of Hawaii and issued by the Experiment Station for circulation among the plantations of the Hawaiian Sugar Planters' Association

OFFICIAL CROP RETURNS.

YIELD OF SUGAR IN THE TERRITORY OF HAWAII FOR THE CROP OF 1918.

TOTAL YIELD.

Acres	Tons of Sugar	Yield per Acre, Lbs.
119,747.15	573,857.9728	9,584

YIELD OF IRRIGATED PLANTATIONS.

Acres	Tons of Sugar	Yield per Acre, Lbs.
65,163.64	404,581.3183	12,417

YIELD OF UNIRRIGATED PLANTATIONS.

Acres	Tons of Sugar	Yield per Acre, Lbs.
54,583.51	169,276.6545	6,202

YIELD BY ISLANDS.

Island	Acres	Tons of Sugar	Yield per Acre, Lbs.
Oahu.....................	23,423.68	162,213.0265	13,850
Kauai.....................	22,902.71	111,822.1168	9,897
Maui.....................	20,749.25	138,297.675	13,330
Hawaii.....................	52,671.51	161,525.1545	5,833

LEAFHOPPER INFESTATION IN PLANT CANE.

By F. Muir.

When discussing some of the causes of leafhopper outbreaks,* and the manner in which fields become infected, there was one aspect of infection of fields of plant cane that was not mentioned. This is by the seed-cane containing hoppers' eggs. This subject also indicates one of the causes why plant cane is more often infected by hoppers than ratoon cane.

Some pieces of seed-cane containing hoppers' eggs were planted in a glass jar in sand, one inch below the surface. The eggs were within a few days of hatching, and the sand was well watered and pressed down hard so that any young hoppers hatching out would have unfavorable conditions to contend against. In spite of this the young shoots were not more than half an inch above the surface when young hoppers appeared on them.

The sugar cane in the Experiment Station ground at the present time contains very few hoppers (from a plantation point of view it is quite free from them), yet out of six sticks of cane selected by the agriculturists for certain purposes and submitted to the entomologists for inspection, four were found to contain hoppers' eggs. This indicates the high percentage of seed cane that must contain hoppers' eggs in an average plantation field.

Seed cane when cut is immediately bagged on the spot and transported to the new field, and the cuttings in one bag are planted in the same row, or adjacent rows. Thus the seed cane from an area infected with leafhoppers' eggs would all be planted within a few square yards.

The soaking of the seed-cane in water for twenty-four hours does not kill the leafhoppers' eggs. This is most likely due to the wax the hoppers place over the egg-punctures.

* Planters' Record, Nov., 1917, pp. 227-230.

This all indicates that a field of young plant cane can be infested from the time it was planted, and certain areas more thickly than others. Unless some immigrant adult hoppers enter the field there will be no eggs for parasites to breed in for three to four weeks, then the generation hatching from the seed-cane will come to maturity and begin ovipositing free from parasites. The length of time they may remain free from parasites depends upon several factors, such as size of area planted, its approximation to other areas of half-grown or full-grown cane containing parasites, prevailing winds, rains, etc. The species of *Ootetrastichus* are much more capable of getting about than *Paranagrus,* both because it is larger and stronger, and because it lives considerably longer.

In the case of a ratoon field the process of burning, harvesting, etc., leaves it practically free of all growth capable of harboring hoppers' eggs, so that the new shoots come up free from hoppers and can only be infected by immigrant adults.

Apart from any question of young plant cane being more pleasing to the hoppers than ratoon cane, the above mentioned facts, I consider, will account, in some degree, for the more frequent outbreaks of leafhoppers in young plant cane than in young ratoon cane.

One of the conclusions to be drawn from this is the advisability of not taking seed-cane from fields, or portions of fields, in which hoppers are numerous.

Observations are now under way to ascertain how long hoppers' eggs can be immersed in water before being killed.

GLYCERINE FROM MOLASSES.*

According to an announcement made on the authority of Government officials, a new process for obtaining glycerine from sugar and molasses has been perfected by A. B. Adams, a member of the American Chemical Society.

The experiments which have resulted in the successful working out of the process, details of which have not been made public, have been going on for some time, having been originally initiated on the strength of information brought back from Germany by Dr. Alonzo E. Taylor, of the Department of Agriculture. Dr. Taylor found that the Germans, having run short of fats, were making glycerine for war uses from sugar.

* Facts About Sugar, Vol. 9, Feb. 22, 1919.

The American experiments to perfect a similar process were undertaken on the initiative of Internal Revenue Commissioner Daniel C. Roper, who had a special laboratory established in the Treasury Department, and a staff of experts set to work making researches.

It is reported that the process worked out has proven entirely successful under practical tests and that some 100 gallons of dynamite glycerine made by it from blackstrap molasses are now on exhibition at the Treasury Department. Samples of it treated by explosive makers at the request of the Government produced a good grade of nitro-glycerine. [W. P. A.]

FERTILIZING PLANT CANE.

Honolulu Plantation Company Experiment No. 2, 1919 Crop*.—Field No. 7, Puuloa.

SUMMARY.

The object of this experiment was to determine the most profitable amount of fertilizer to apply to plant cane when grown under irrigated conditions in fairly fertile land.

The experimental cane was Lahaina, cut back in July, 1917. The experiment consisted of 48 plots, each 1/10 acre, gross area. Each treatment had twelve repetitions. Six of the plots in this area developed Lahaina disease. In figuring the results these plots were discarded.

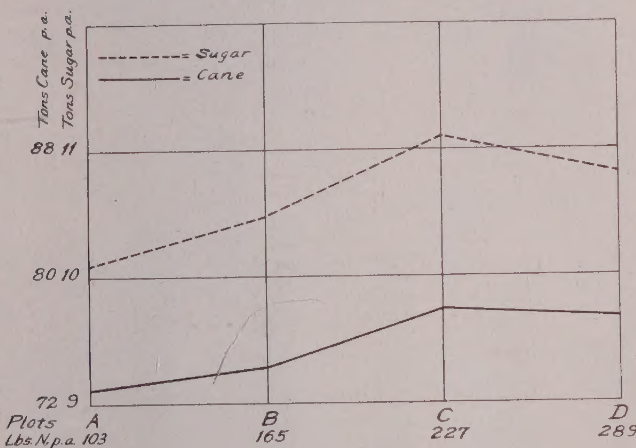
During the first growing season (on September 5, 1917) all the plots received a uniform fertilization of 800 pounds of high grade per acre. This high grade contained 9% nitrogen and 7% phosphoric acid.

During the second growing season this experiment was fertilized as follows:

Plots	April 17, 1918	July 3, 1918
A	100 lbs. Nit. Soda	100 lbs. Nit. Soda
B	300 " " "	300 " " "
C	500 " " "	500 " " "
D	700 " " "	700 " " "

* Experiment planned and laid out by J. A. Verret. Fertilized and harvested by Y. Kutsunai.

CURVES SHOWING COMPARATIVE YIELDS
OF DIFFERENT FERTILIZER TREATMENTS
Honolulu Plantation Co. Exp. 2, 1919 Crop



The results of the harvest are given below:

Treatment			Lbs. of Nit. per Acre	Yield per Acre		
Sept. 5, 1917	Apr. 17, 1918	July 3, 1918		Cane	Q. R.	Sugar
800 lbs. H. G.*	100 lbs. Nit. Soda	100 lbs. Nit. Soda	103	72.8	7.23	10.07
800 " "	300 " " "	300 " " "	165	74.3	7.10	10.46
800 " "	500 " " "	500 " " "	227	78.0	7.03	11.09
800 " "	700 " " "	700 " " "	289	77.3	7.15	10.80

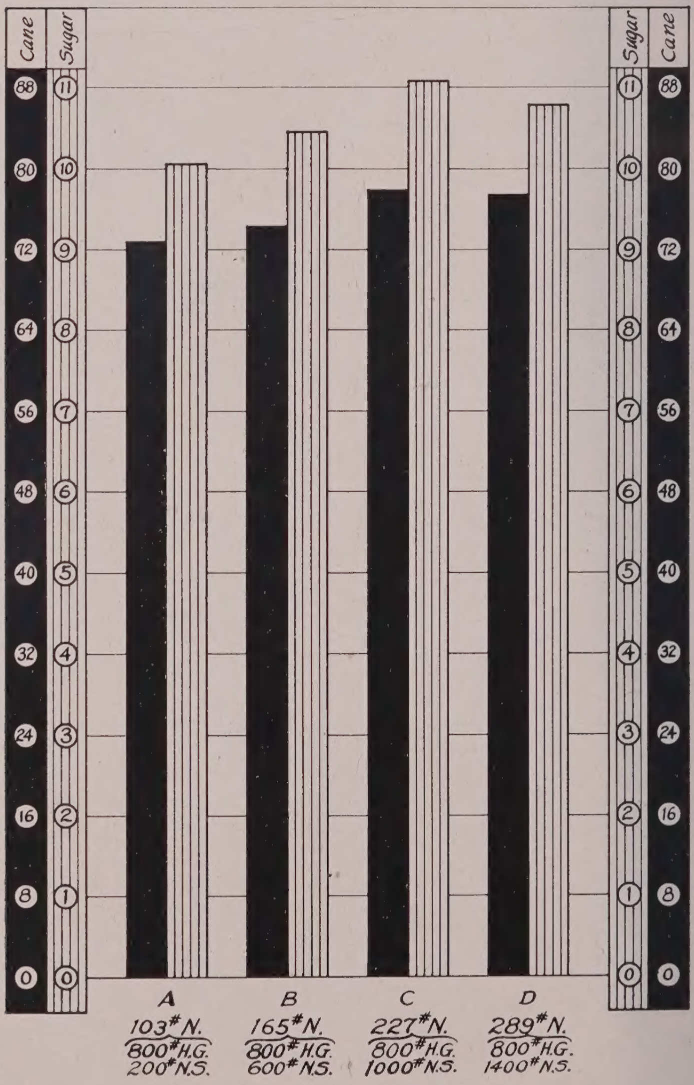
* H. G. = High Grade of following composition: 9% Nitrogen, 7% Phosphoric Acid.

In this case the limit of profitable fertilization was reached when 227 pounds of nitrogen per acre had been applied. Beyond this point further applications of fertilizer did not produce any further gains. Results of a similar nature were obtained at McBryde. (See McBryde Exp. No. 1, May Record.)

Increasing the nitrate of soda applied during the second season from 200 pounds per acre to 1000 pounds per acre produced a gain of one ton of sugar. That is, 800 pounds of nitrate of soda, or 124 pounds of nitrogen, produced one ton of sugar.

AMOUNT OF FERTILIZER TO APPLY.

Honolulu Plantation Co. Exp. 2, 1919 Crop
Puuloa #7 Field.



H.G. = 9% Nitrogen, 7% P2O5.
N.S. = Nitrate Soda 15.5% Nitrogen.

DETAILS OF EXPERIMENT.

Fertilizer—Amount to Apply, Second Season.

Object.

To determine the most profitable amount of fertilizer to apply during second growing season to plant cane on an irrigated plantation.

Location.

Honolulu Plantation Co., Field 7, Puuloa Section.

Crop.

Lahaina, plant cane.

Layout.

Plots—48. Each 1/10 acre. (This includes watercourses but not ditches.) Each plot consists of 20 rows one watercourse in length.

Plan.

FERTILIZATION—POUNDS PER ACRE.

Plots	No. of Plots	Sept. 5, 1917	April 7, 1918	July 3, 1918	Pounds of Nitrogen
A	12	800 lbs. H. G.*	100 lbs. N. S.†	100 lbs. N. S.†	103
B	12	800 " "	300 " "	300 " "	165
C	12	800 " "	500 " "	500 " "	227
D	12	800 " "	700 " "	700 " "	289

* H. G. = High Grade: 9% N. (5% Sul., 3% Nit., 1% Organic), 7% P_2O_5—Superphosphate.

† Nitrogen Soda = 15.5% N.

Progress Notes.

July 30, 1917—Experiment laid out.
August 20, 1917—Experiment staked.
September 5, 1917—First fertilization.
November 26, 1917—Following observations made by Y. Kutsunai:

Observed Honolulu Plantation Company Experiments Nos. 2 and 3. "Lahaina disease" broke out in several plots. Healthy canes are about 8 feet high, but those affected are only 4 to 5 feet in height.

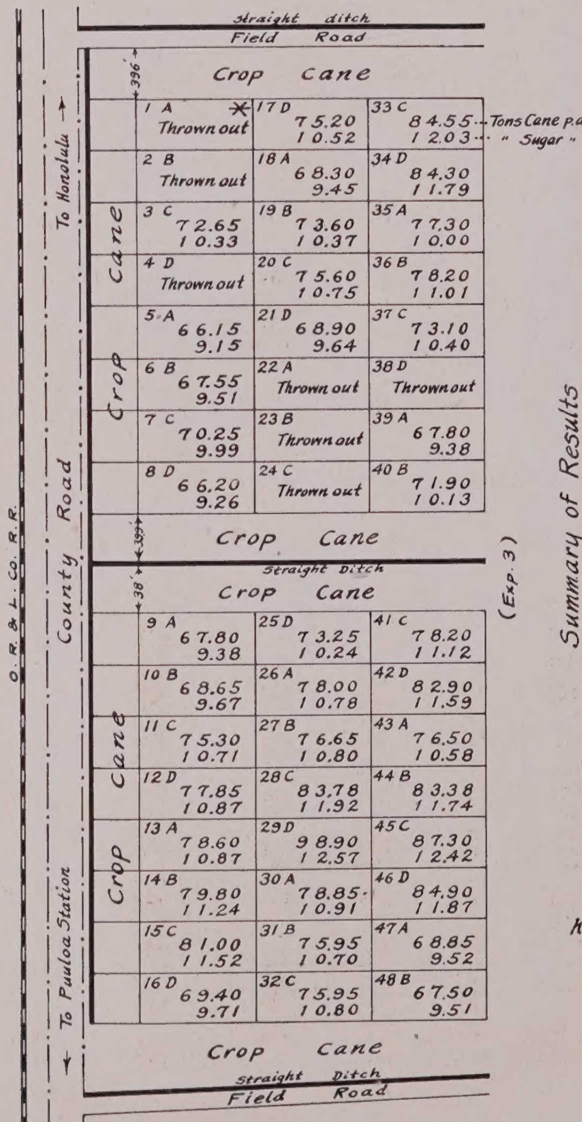
Experiment No. 2. Diseased areas show yellow stripe disease also.

Plot 1: West half of whole plot and east 10 feet of rows 14-20 are stunted.
Plot 2: Rows 19 and 20 and west ¾ of rows 10 to 20 are stunted.
Plot 3: A trifle affected all over.
Plots 4 to 16 are healthy.
Plot 17: Rows 1 to 4 are stunted.
Plot 18: Rows 1 to 4 are stunted.
Plot 19: Rows 3 to 6 are stunted.
Plot 20 is healthy.
Plot 21: Rows 5 and 6 are affected on the western side.
Plot 22: Rows 3 to 8, and east 15 feet of rows 15 to 17 diseased.

AMOUNT OF FERTILIZER TO APPLY.

Honolulu Plantation Co. Exp.#2, 1919 Crop

Puuloa #7 Field.



Summary of Results

Plots	Treatment	Lbs. Fert.	T. Cane p.a.	Q.R.	T. Sugar p.a.
A	103# N.	1000	72.81	7.23	10.07
B	165# N.	1400	74.32	7.10	10.46
C	227# N.	1800	77.97	7.03	11.09
D	289# N.	2200	77.28	7.15	10.80

Key: ✱ = Lahaina disease

Plot 23: East 10 feet of rows 3 to 7 are diseased.
Plot 24: Healthy.
Plot 25: Rows 1 to 10 slightly affected.
Plots 26 to 41: Healthy.
Plot 41: Rows 1 to 3 very slightly stunted.
Plots 42 to 48: Healthy.

April 17, 1918—Second application of fertilizer.
July 3, 1918—Third application of fertilizer.
March 6, 1918—Began harvest.

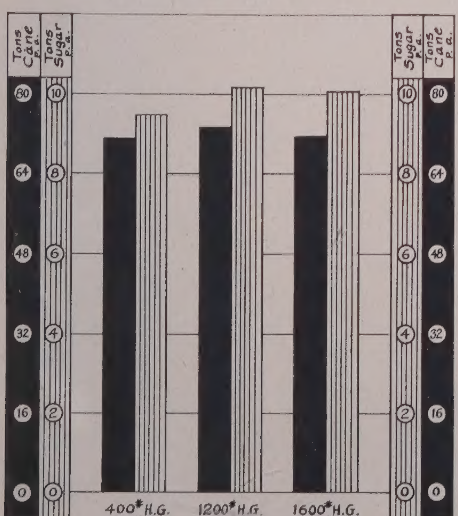
The juices were sampled at the mill by R. Pahau, car samples being taken from the crusher juices. The various samples were averaged for each treatment. J. A. V.

FIRST SEASON FERTILIZATION.

Honolulu Plantation Co. Experiment No. 3, 1919 Crop.*

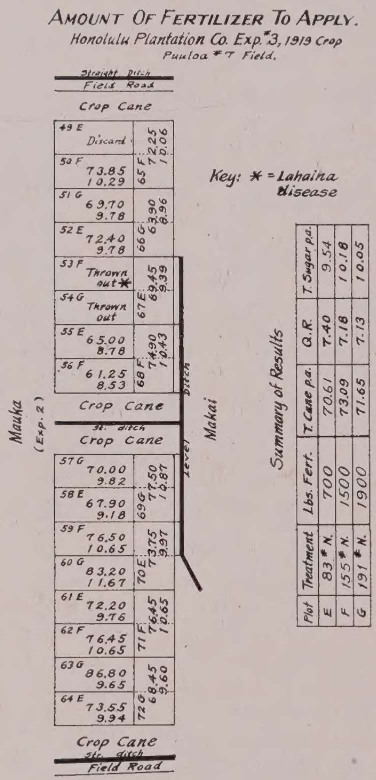
In this experiment varying amounts of mixed fertilizer were applied during the first season. This mixed fertilizer contained 9% nitrogen and 7% phosphoric acid. It was put on in one dose

AMOUNT OF FERTILIZER TO APPLY
Honolulu Plantation Co. Exp. #3 1919 Crop
Puuloa #7 Field



Note: H.G = 9% Nitrogen, 7% P_2O_5.

* Experiment planned and laid out by J. A. Verret; fertilized and harvested by Y. Kutsunai.



on September 5, 1917. The E plots received 400 pounds per acre, the F plots 1200 pounds, and the G plots 1600 pounds. In addition to this all plots received 300 pounds of nitrate of soda per acre in one application in April. The original plan of the experiment called for an additional 300 pounds of nitrate in July, but on account of nitrate shortage this was not applied. This fertilization is given in detail in the following table:

FERTILIZER—POUNDS PER ACRE.

Plots	No. of Plots	September 4, 1917	April 18, 1918	Total Pounds of Nitrogen
E	8	400 lbs. High Grade	300 lbs. Nit. Soda	83
F	8	1200 " " "	300 " " "	155
G	8	1600 " " "	300 " " "	191

The experimental cane was Lahaina, plant, cut back in July, 1917. The test comprised 24 plots, each 1/10 of an acre in size. Plots 53 F and 54 G developed Lahaina disease and were discarded.

The yields per acre obtained in this experiment are given in the following table:

Plots	Treatment		Total Lbs. Nitrogen	Yield per Acre		
	Sept. 5, 1917	April, 1918		Cane	Q. R.	Sugar
E	400 lbs. H. G.*	300 lbs. Nit. Soda	83	70.61	7.40	9.54
F	1200 " "	300 " " "	155	73.09	7.18	10.18
G	1600 " "	300 " " "	191	71.65	7.13	10.05

* H. G. = A mixed fertilizer containing 9% N. and 7% P_2O_5.

Increasing the mixed fertilizer applied during the first season from 400 pounds to 1200 pounds produced a gain of 0.64 ton of sugar per acre. Further increases of fertilizer produced no further gains of sugar.

The yields in this experiment should be studied in connection with those of Honolulu Experiment No. 2, reported on page 382 of this *Record*. These two experiments adjoin each other on soil which appears to be fairly uniform, so the results should be comparable.

A comparison of these two experiments tends to show that better results are obtained by increasing the nitrate applied during the second season rather than by increasing the high grade during the first season. In Experiment No. 2, 800 pounds of high grade during the first season, and 600 pounds of nitrate during the second, produced 10.46 tons of sugar per acre, while in Experiment No. 3, 1200 pounds of high grade during the first season, and 300 pounds of nitrate during the second season, produced 10.18, a difference of 0.28 ton of sugar in favor of nitrate when using about the same amount of nitrogen; that is, 155 pounds and 165 pounds respectively.

The efficiency of nitrate fertilization during the second season was brought out in another way also in these tests. By using varying amounts of high grade during the first season and nominal amounts of nitrate (300 pounds) during the second season, the limit in increase in yield of sugar was reached with 10.18 tons per acre, while with increasing amounts of nitrate during the second season this limit was not reached until 11.09 tons of sugar per acre were produced, a difference of one ton of sugar.

By combining the results of the two experiments and arranging them in the order of sugar yields, we obtain the following table:

Plots	TREATMENT			YIELD PER ACRE		
	Sept. 5, 1917	Apr. 17, 1918	July 3, 1918	Cane	Q. R.	Sugar
E	400 lbs. H. G.	300 lbs. Nit. S.	0	70.6	7.40	9.54
G	1600 " "	300 " "	0	71.7	7.13	10.05
A	800 " "	100 " "	100 lbs. Nit. S.	72.8	7.23	10.07
F	1200 " "	300 " "	0	73.1	7.18	10.18
B	800 " "	300 " "	300 lbs. Nit. S.	74.3	7.10	10.46
D	800 " "	700 " "	700 " "	77.3	7.15	10.80
C	800 " "	500 " "	500 " "	78.0	7.03	11.09

To recapitulate, we find, in these tests with plant cane, that increasing the nitrogen from 83 pounds per acre to 227 produced an increase of 1.55 tons of sugar per acre. This increase was obtained from 400 pounds of high grade and 700 pounds of nitrate of soda.

EXPLANATION OF EXPERIMENT.

Fertilizer—Amount to Apply, First Season.

Object.

To determine the most profitable amount of fertilizer to apply during the first growing season to plant cane.

Location.

Honolulu Plantation Co., Field 7, Puuloa Section.

Crop.

Lahaina, plant cane.

Layout.

No. of plots—24. Each 1/10 acre. (This includes watercourses but not ditches). Plots 49 to 64 inclusive consist of 20 rows one watercourse in length. Plots 65 to 72 inclusive consist of 10 lines two watercourses in length.

Plan.

FERTILIZATION—POUNDS PER ACRE.

Plots	No. of Plots	Sept. 5, 1917	April 17, 1918	Total Lbs. of Nitrogen
E	8	400 lbs. H. G.*	300 lbs. N. S.	83
F	8	1200 " "	300 " "	155
G	8	1600 " "	300 " "	191

* H. G. = High Grade: 9% N. (5% Sul., 3% Nit., 1% Organic), 7% P_2O_5 — Superphosphate.

Nitrogen Soda = 15.5% N.

Progress of Work.

July 30, 1917—Experiment laid out.
August 20, 1917—Experiment staked.
September 4, 1917—Experiment fertilized (high grade).
November 26, 1917—Following observations made:

Lahaina disease broke out in several plots. Healthy canes are about 8 feet high, but those affected are only 4 to 5 feet in height. The diseased area shows yellow stripe disease also.

Plot 49: Very slight attack of disease.
Plot 50: Healthy.
Plot 51: West half of rows 19 and 20 affected.
Plot 52: Healthy.
Plot 53: Healthy.
Plot 54: West 15 feet of rows 2 to 5 are affected.
Plots 55 to 72: Healthy.

April 18, 1918—Second fertilization (nitrate).
March, 1919—Experiment harvested.

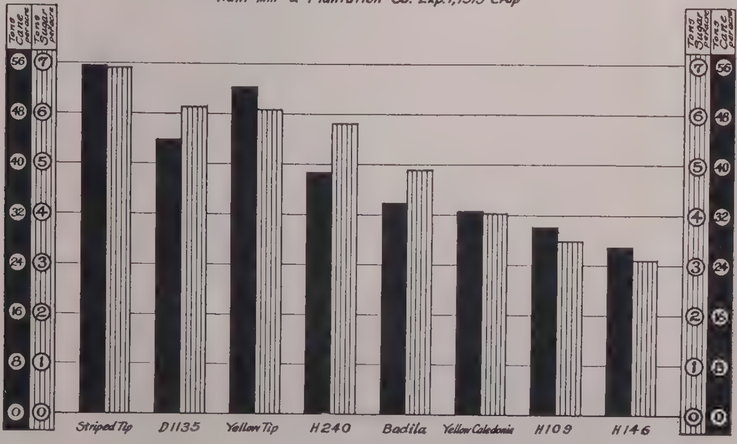
The juices were sampled in car lots at the mill by Mr. Pahau, and the analyses averaged for each treatment. J. A. V.

STRIPED TIP GOOD UNDER DROUGHT CONDITIONS.

HAWI EXPERIMENT NO. 1 (1919 PLANT CROP).*

In this experiment Striped Tip cane is compared with the following varieties: D 1135, Yellow Tip, H 240, Badila, Yellow Caledonia, H 109, H 146. The field where this test was made is at an elevation of 1400 feet, and in a windy and exposed location.

VARIETY TEST
Hawi Mill & Plantation Co. Exp. 1, 1919 Crop



* Experiment planned by L. D. Larsen and W. P. Alexander.
Experiment laid out by W. P. Alexander.
Experiment harvested by G. B. Grant.

The results show that Striped Tip gave consistently the best yields, averaging 6.29 tons of sugar for the 60 plots. It was followed by D 1135 and Yellow Tip, with 6.15 and 6.10 tons of sugar respectively. The gain in favor of Striped Tip over the 18 plots of D 1135 averaged 11.63 tons of cane and 0.77 ton of sugar.

The summary of the results is as follows:

Variety	No. of Plots	Yield per Acre		
		Cane	Q. R.	Sugar
Striped Tip	60	55.61	8.04	6.92
D 1135	18	43.98	7.15	6.15
Yellow Tip	10	52.26	8.57	6.10
H 240	10	38.73	6.67	5.81
Badila	10	33.91	6.92	4.90
Yellow Caledonia	10	32.46	8.00	4.06
H 109	10	30.04	8.62	3.48
H 146	8	26.95	8.69	3.10

During the first growing period these varieties had to stand the strain of the adverse weather conditions of 1917. This most severe drought which Hawi experienced (only 30.52 inches of rain falling as against a normal record of 60.19 inches) showed in this experiment that we can expect of Tip canes and D 1135, on unirrigated upland fields, a greater resistance against adverse conditions than the less hardy varieties of Yellow Caledonia, H 109 and H 146.

Observation notes on this experiment show that the stand of H 109 and H 146, especially, was not comparable with that of the other varieties. It is a recognized practice to plant Yellow Caledonia only below an elevation of 1000 feet, but this experiment points out that a loss of almost 2 tons of sugar resulted when an attempt was made to grow this standard variety at high elevation instead of a better adapted variety.

Hawi is fortunate that Yellow Stripe disease has never caused much damage in its fields of Tip canes, which in 1918 covered 212 acres, 11% of the crop. In Hamakua, however, the ravages of this disease make extensive planting of this variety a dangerous practice, and anything in favor of the Tip canes must be balanced by a warning.

Yellow Stripe disease has caused great damage in other localities in the past, and the only known remedy for the disease is to replace it with a non-susceptible variety. For this reason the Experiment Station has recommended the gradual substitution of other varieties for ones susceptible to the Yellow Stripe disease.

VARIETY TEST

Hawi Mill & Plantation Co. Exp. #1, 1919 crop

Field Road

41 lines Crop cane (H240)

1 49.90 S.T. 6.21	31 37.98 Y.T. 4.43	61 58.06 S.T. 7.22	91 46.09 D1135 6.45	121 35.67 H146 4.10
2 23.32 H109 2.71	32 43.94 S.T. 5.46	62 32.43 Y.C. 4.05	92 62.46 S.T. 7.77	122 54.13 D1135 7.57
3 47.50 S.T. 5.91	33 24.95 Bad. 3.61	63 56.93 S.T. 7.08	93 41.87 H240 6.28	123 28.61 H146 3.29
4 55.73 Y.T. 6.50	34 50.99 S.T. 6.34	64 47.60 D1135 6.66	94 65.92 S.T. 8.20	124 40.81 D1135 5.71
5 53.46 S.T. 6.65	35 29.34 H109 3.40	65 63.71 S.T. 7.92	95 31.86 Y.C. 3.98	125 26.15 H146 3.01
6 22.86 Bad. 3.30	36 59.56 S.T. 7.41	66 40.20 H240 6.03	96 59.51 S.T. 6.41	126 36.88 D1135 5.16
7 45.45 S.T. 5.65	37 46.89 D1135 6.56	67 62.99 S.T. 7.83	97 62.80 Y.T. 7.33	127 23.03 H146 2.65
8 23.90 Y.C. 2.99	38 61.39 S.T. 7.64	68 28.50 H109 3.31	98 63.76 S.T. 7.92	128 40.37 D1135 5.65
9 56.65 S.T. 7.05	39 33.22 H240 4.98	69 58.53 S.T. 7.28	99 33.69 Bad. 4.87	129 27.43 H146 3.16
10 42.63 D1135 5.96	40 55.06 S.T. 6.85	70 49.14 Y.T. 5.73	100 56.15 S.T. 6.98	130 37.17 D1135 5.20
11 52.30 S.T. 6.50	41 29.42 Y.C. 3.68	71 29.16 S.T. 3.63	101 27.82 H109 3.23	131 22.77 H146 2.62
12 34.78 H240 5.21	42 57.66 S.T. 7.17	72 25.64 Bad. 3.70	102 52.99 S.T. 6.59	132 36.46 D1135 5.10
13 40.66 S.T. 5.06	43 51.41 Y.T. 6.00	73 44.21 S.T. 5.50	103 42.82 D1135 5.99	133 24.88 H146 2.86
14 29.39 H109 3.41	44 51.70 S.T. 6.43	74 27.78 Y.C. 3.47	104 58.85 S.T. 7.32	134 41.75 D1135 5.84
15 48.02 S.T. 5.97	45 28.33 Bad. 4.09	75 43.09 S.T. 5.36	105 40.67 H240 6.10	135 27.03 H146 3.11
16 51.95 Y.T. 6.06	46 50.12 S.T. 6.23	76 44.25 D1135 6.18	106 54.30 S.T. 6.75	136 36 76 D1135 5 14
17 40.64 S.T. 5.05	47 27.53 H109 3.19	77 49.60 S.T. 6.17	107 27.59 Y.C. 3.45	
18 41.33 Bad. 5.97	48 56.18 S.T. 6.99	78 42.48 H240 6.37	108 51.25 ··Tons Cane p.a. S.T. 6.37 ··Tons Sugar p.a.	
19 56.51 S.T. 7.03	49 53.57 D1135 7.49	79 62.59 S.T. 7.78	109 53.91 Y.T. 6.29	
20 46.57 Y.C. 5.82	50 58.21 S.T. 7.24	80 33.00 H109 3.83	110 64.45 S.T. 8.02	
21 56.89 S.T. 7.08	51 39.75 H240 5.96	81 55.02 S.T. 6.84	111 38.63 Bad. 5.58	
22 50.68 D1135 7.09	52 57.05 S.T. 7.10	82 54.89 Y.T. 6.40	112 56.67 S.T. 7.05	
23 57.75 S.T. 7.18	53 36.35 Y.C. 4.54	83 64.64 S.T. 8.04	113 35.97 H109 4.17	
24 38.09 H240 5.71	54 48.00 S.T. 5.97	84 42.15 Bad. 6.09	114 63.18 S.T. 7.86	
25 62.88 S.T. 7.82	55 43.92 Y.T. 5.12	85 65.09 S.T. 8.10	115 45.19 D1135 6.32	
26 26.09 H109 3.03	56 57.48 S.T. 7.15	86 33.16 Y.C. 4.15	116 51.15 S.T. 6.36	
27 59.10 S.T. 7.35	57 38.12 Bad. 5.51	87 50.82 S.T. 6.32	117 36.20 H240 5.43	
28 60.85 Y.T. 7.10	58 71.06 S.T. 8.84	88 47.45 D1135 6.65	118 53.01 S.T. 6.59	
29 70.25 S.T. 8.74	59 39.42 H109 4.57	89 43.34 S.T. 5.39	119 35.49 Y.C. 4.44	
30 43.31 Bad. 6.26	60 58.94 S.T. 7.33	90 40.06 H240 6.06	120 55.37 S.T. 6.89	

Rocks

Cistern

Rocks

Rocks

Summary of Results

Variety	No. of Plot	Yield per acre Cane	Q.R.	Sugar
S.T.	60	55.61	8.04	6.92
D1135	18	43.98	7.15	6.15
Y.T.	10	52.26	8.57	6.10
H240	10	38.73	6.67	5.81
Bad.	10	33.91	6.92	4.90
Y.C.	10	32.46	8.00	4.06
H109	10	30.04	8.62	3.48
H146	8	26.95	8.69	3.10

Key :-

S.T. = Striped Tip
Y.T. = Yellow Tip
Y.C. = Yellow Caledonia
Bad. = Badila

DETAILED ACCOUNT.

Variety Test.

Object.

To compare Striped Tip, Yellow Tip, D 1135, H 109, H 146, H 240, Yellow Caledonia and Badila.

Location.

Hawi Mill and Plantation Co., in Field 13-B, on Kohala side of the field. Elevation 1400 feet.

Crop.

Eight varieties—plant cane.

Layout.

No. of plots: 136.
Size of plots: 1/20 acre.
Each plot consists of 6 lines, each line being 5.1 feet wide and 71.3 feet long.

Plan.

60 plots Striped Tip,
10 plots Yellow Tip,
18 plots D 1135,
10 plots H 109,
8 plots H 146,
10 plots H 240,
10 plots Yellow Caledonia,
10 plots Badila.
(Plan for planting, see diagram.)

Fertilization.

Uniform.

Progress.

May 3-5, 1917—Experiment laid out and planted.
December 16, 1918—Fertilized with 385 lbs. of High Grade per acre.
April 24, 1918—Fertilized with 400 lbs. of High Grade per acre.
January 23—Experiment harvested.

W. P. A.

BADILA AND H 456 SHOW BEST IN WAILUKU TEST.

WAILUKU EXPERIMENT NO. 5, 1919 CROP.

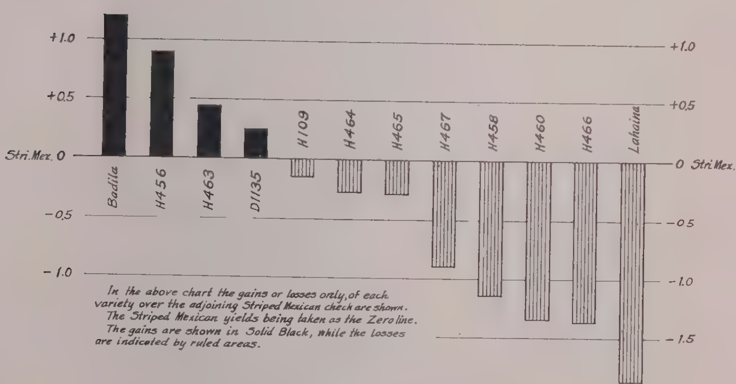
SUMMARY.

This experiment consisted of a comparison of the following varieties of plant cane: Striped Mexican, Lahaina, H 109, Badila, D 1135, H 466, H 465, H 464, H 463, H 460, H 458, H 457 and H 456. The Striped Mexican was used as check and planted in every other plot. The field was planted July 9-13, 1917, and harvested from January 21 to February, 1919.

COMPARATIVE VARIETY YIELDS.

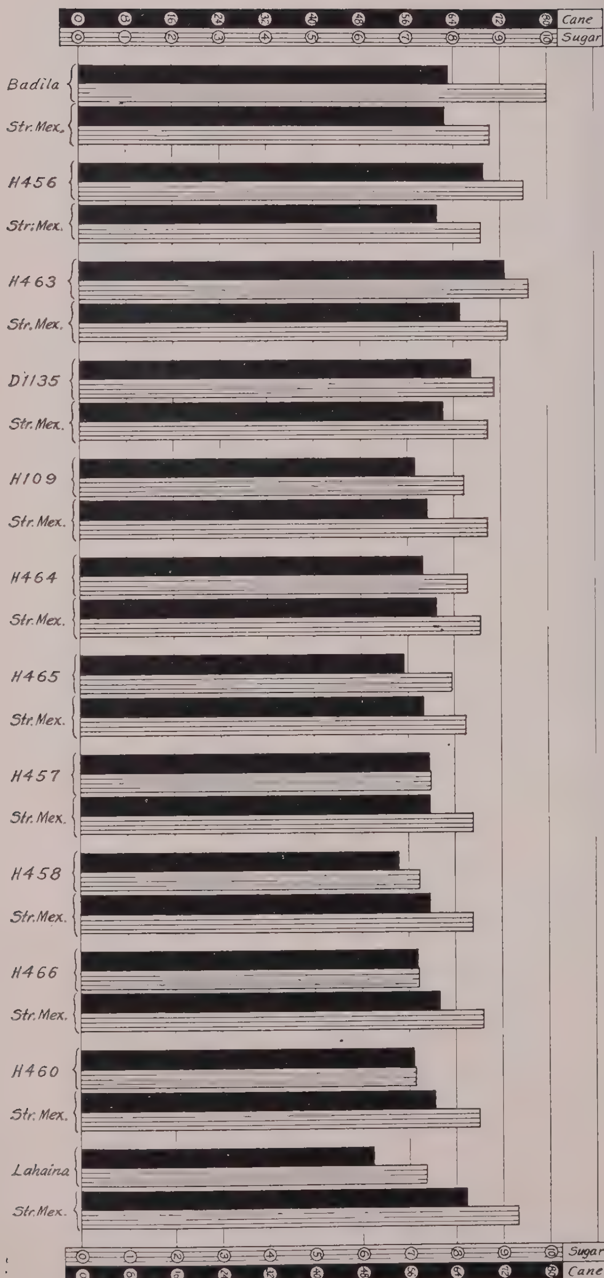
Showing gains or losses in tons of sugar per acre over Striped Mexican.

Wailuku Sugar Co. Exp. 5, 1919 Crop



The germinations of all the varieties were good, except that of H 109. The H 109 seed used was body seed from vigorous growing plant cane. The H 109 plots were replanted in August, 1917.

The results of the harvest are given below. The varieties in this table are arranged in the order of their gain or loss in sugar per acre when compared to the Striped Mexican plots immediately adjoining.



VARIETY TEST

Average yields of varieties arranged in order of gain or loss of sugar over adjoining check plots.

Wailuku Sugar Co. Exp. #5, 1919 Crop

Variety	Yield per Acre			Gain or Loss over adjoining Check Plots	
	Cane	Q. R.	Sugar	Cane	Sugar
Badila	63.21	6.32	10.00	+ .61	+1.21
H 456	69.28	7.29	9.50	+ 8.02	+0.90
H 463	72.91	7.59	9.61	+ 7.67	+0.45
D 1135	67.13	7.47	8.99	+ 4.89	+0.25
Striped Mexican ..	61.63	7.12	8.66	.....	....
H 109	57.39	6.98	8.22	— 2.17	—0.15
H 464	58.88	7.10	8.29	— 2.14	—0.28
H 465	55.43	6.96	7.96	— 3.32	—0.29
H 457	59.70	7.96	7.50	— 0.14	—0.90
H 458	54.31	7.50	7.24	— 5.38	—1.14
H 460	56.78	7.94	7.15	— 3.72	—1.35
H 466	57.59	7.96	7.23	— 3.62	—1.37
Lahaina	49.93	6.78	7.36	—15.76	—1.87

These results place Badila and H 456 in the first rank. H 463 also shows up well. Of the others, D 1135, Striped Mexican, H 109, H 464 and H 465 are to be classed together. H 109, on account of poor germination, made a slow start, and it is to be expected that it will show up better in the ratoons. H 465 has good juices, and has been ratooning well at Waipio, and we believe it will show up better in the next crop.*

The remaining varieties were inferior, Lahaina being especially poor.

DETAILS OF EXPERIMENT.

Variety Comparison.

Object.

To compare Striped Mexican, Lahaina, H 109, Badila, D 1135, H 466, H 465, H 464, H 463, H 460, H 458, H 457 and H 456 under conditions prevailing at Wailuku.

Location.

Wailuku Sugar Co., Field 45, on the Wailuku side of the 1917 seedlings.

Crop.

Plant cane—13 varieties.

Layout.

128 plots; each 1/20 acre (72.6′x 30′), consisting of 12 single rows (6 double rows). Each plot is two watercourses in width.

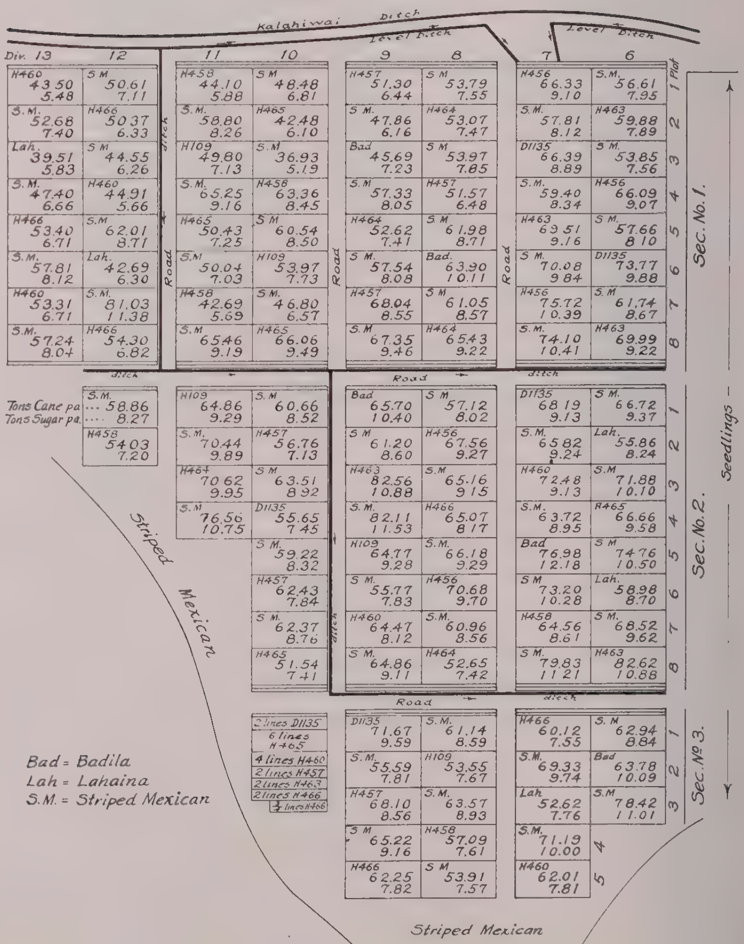
Plan.

For plan of planting see diagram.

* An inspection lately made at Grove Farm shows H 465 to be suffering badly from eye-spot and yellow stripe.

VARIETY TEST

Wailuku Sugar Co. Exp. #5, 1919 Crop



Striped Mexican—64 plots. Lahaina, H 109, Badila, D 1135, H 465, H 464, H 463 and H 456—5 plots each. H 466, H 460, H 458 and H 457—6 plots each.

Fertilization.

Uniform to all plots.

POUNDS NITRATE OF SODA PER ACRE.

August 1, 1917	November 1, 1917	February 1, 1918	May 1, 1918
450 lbs. B-5	450 lbs. B-5	200 lbs. N. S.	200 lbs. N. S.

B-5 fert. = 11% N. (5% Sul., 5% Nit., 1% Organic),
8% P_2O_5 (5% Bone, 3% Superphosphate).
N. S. = Nitrate of Soda: 15.5% N.

Experiment planned and laid out by J. T. Moir, Jr.

Progress.

July 9-13, 1917—Experiment planted. Seed of varieties of seedlings cut from body seed.

August 6, 1917—H 109 needs replanting. Other germinations good.

August 17, 1917—H 109 replanted. Four bags of seed per plot required.

August 18, 1917—Experiment fertilized at the rate of 450 pounds per acre of complete fertilizer.

December 5, 1917—Second application of fertilizer at the rate of 500 pounds B-5 per acre.

January 14, 1918—Varieties looking well.

February 19, 1918—Kona storm damaged varieties. All cane seems to be lying down, but not much broken. H 456 doing best of lot.

March 5, 1918—Striped Mexican shows effect of storm more than "400" varieties.

March 25, 1918—Third application of fertilizer at the rate of 200 pounds of nitrate of soda per acre.

June 24, 1918—Fourth application of fertilizer at the rate of 200 pounds of nitrate of soda per acre.

January 27-February 5, 1919—Harvested. The fourth row from mauka of each plot in divisions 12 and 13 was cut and weighed on platform scales. The remaining cut cane on plots 1-12-8, 1-12-17 and 1-13-18 was weighed entire.

The juice sample was obtained from a bundle of 10 sticks from each division, and run through the laboratory hand mill three times. The quality ratio given, therefore, is better than would be obtained in regular milling.

These analyses were made by the Wailuku Sugar Co. laboratory.

J. A. V.

WAX FROM THE SUGAR CANE.

Wax for some time past has formed one of the by-products of the sugar industry in Natal, South Africa, and its manufacture (by the Natal Cane By-products Co., Ltd., of Durban) is now making very active progress, says *Industrial South Africa*. The

process (which is patented) is somewhat intricate, but the treatment applied to an otherwise waste product (filter-press cake from the sugar factories) results in the production of a very fine, hard, vegetable wax practically equal to Carnauba and beeswax, with which latter it is, chemically, almost identical.

The wax has a high melting point and takes a very high polish. After the extraction of the wax the large residue forms a fertilizer which is used entirely by the sugar estates forwarding their filter-press cake for treatment.

The company has also equipped a refining plant for treating crude wax for export and for supplying an apparently general demand by manufacturers of furniture and boot polishes in the Union. About 250 tons of this wax have been shipped to London during the past two years.

[W. P. A.]

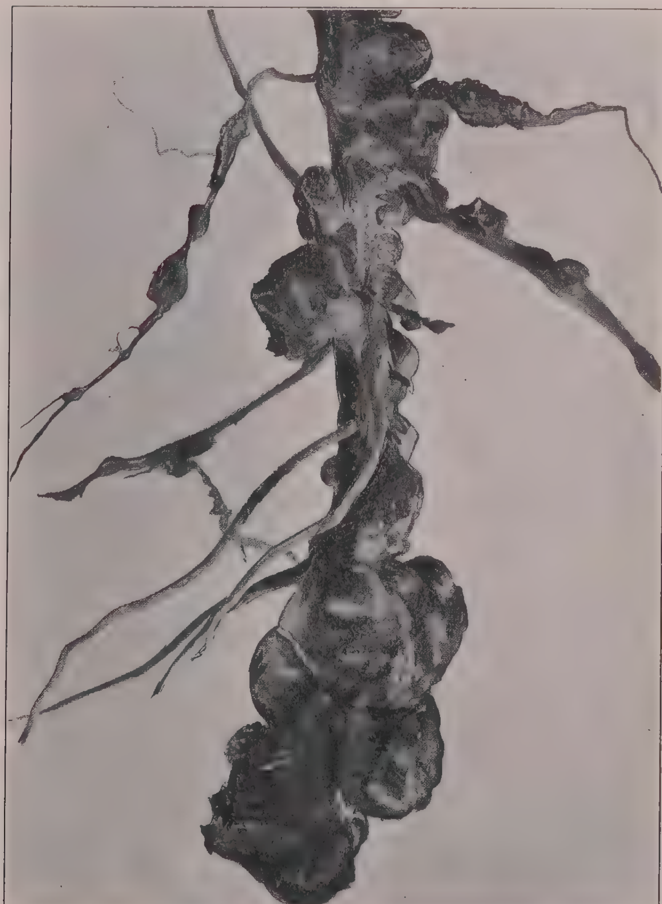
CONTROL OF ROOT-KNOT BY CALCIUM CYANAMIDE.

In Bulletin 136 of the Agricultural Experiment Station of the University of Florida, J. R. Watson relates experiments conducted to determine methods of control of nematodes. The following description of the nematode worm is given:

Root-knot is a disease of certain plants, characterized by irregular swellings of the roots. These should not be confused with the nodules of the nitrogen-fixing bacteria which are found on most legumes and a few other plants. Such nodules are usually small, roundish, and all on any given plant are of about uniform size and appearance; also, they are attached loosely to the root. The galls of the root-knot nematodes vary much in size and shape, and are swellings in the root itself instead of being attached to it. Above the ground the symptoms of the presence of root-knot are, progressively, a checking of plant growth, failure to produce normal fruits, a yellow, sickly appearance and a premature death.

CAUSE.

These swellings are caused by minute worms which belong to the group commonly known as eel-worms or round worms, and technically called nematodes. They are related to hook worms, "vinegar eels" and intestinal worms. The males are long and



Nematodes or Rootknot on Watermelon.

slender, but the adult females are pear-shaped. Both are minute, and barely visible to the unaided eye.

After fertilization, the females produce young which are slender like the mature males. These force their way through the soil until they find the roots of some attractive food plant. They bore into the roots to feed on the tissue, and probably give off a poison which stimulates the plant to produce the swelling or gall.

The worms travel slowly through the soil, a foot or two a month being about the maximum rate. But they may be carried by rain water much more rapidly. They are not commonly found on newly-cleared land, but old, long-cultivated fields in the sandy soils of Florida usually have a more or less heavy infestation.

Experiments were undertaken with "diseased" radishes, cow peas, winter truck garden produce, using calcium cyanamide to eradicate the nematodes. This "Cyanamid" is the trade name for a mixture consisting chiefly of the chemical compound calcium cyanamide (about 45%); and hydrated lime (27%), carbon (13%), calcium carbonate (4%), and calcium sulphide (2%). It is a black powder, the color being due to the carbon. It is a concentrated nitrogenous fertilizer which analyzes from 15 to 24 per cent ammonia. At present prices, it is the cheapest source of ammonia available among commercial fertilizers. It contains no potash or acid phosphate, and therefore is not a complete fertilizer.

The valuable ingredient of "cyanamid" is the calcium cyanamide ($CaCN_2$). It is this component that kills the nematodes and adds the plant food to the soil. When moderate doses are mixed with soil, calcium cyanamide quickly disintegrates, probably changing first to urea, then to ammonia, and then to nitrates. In large doses, however, some of it may go into a polymeric form called "dicyanamide." This disintegrates more slowly and has a very harmful effect on any crop that is planted too soon after the application of the cyanamid. This effect is much more pronounced when the soil is dry. Too large an amount of cyanamid will have the same effect even if no dicyanamide is formed.

The experiment with radish seemed to indicate that: (1) Cyanamid used at the rate of 1600 pounds or more per acre markedly reduced the number of nematodes present; and (2) if used too strong or applied too near the time of planting, it inhibits growth or entirely kills the young seedlings.

Thinking that the material would penetrate the soil better if applied in solution, the cyanamid was dissolved in water and the

soil thoroughly drenched. Contrary to expectations, this method did not yield as satisfactory results as that first tried.

Mr. Watson summarizes his conclusions as follows:

CONCLUSION.

The results of these representative experiments, in connection with others which gave similar results, the details of which are not given here, justify the following conclusions. Cyanamid applied at rates of from one to three tons per acre, according to the nature and the depth to which the soil is infested, and thoroughly mixed with the soil, reduces the number of nematodes present to an extent sufficient to make it possible to grow with profit susceptible plants on land which, before treatment, would not produce them profitably. The reduction, in some cases, amounted to apparent extermination.

THE DOSE.

The thoroughness of the control will depend upon several factors. The dose is one of the most important. This will depend much upon the depth of the soil or the depth to which the nematodes are found. The character of the soil is, apparently, also important. In one case, a dose of one-half ton per acre on the very light, sandy, pineapple soils (old established dunes) about Fort Pierce, seem to have produced as good results as two or three tons on the Station farm at Gainesville.

MANNER OF APPLICATION.

The manner of application is a very important factor. Cyanamid even when in solution does not penetrate the soil to any considerable depth. It is quickly absorbed by certain constituents of the soil called colloids. The scarcity of these compounds in the sandy soils of the Fort Pierce section probably accounts for the comparative effectiveness of the small dose mentioned above. It is probably this absorption by the colloids which is responsible for the poor results obtained when the material was applied in solution. The top layer of the soil absorbs the material and the nematodes in the deeper layers escape. The same results followed when all of the dose was applied as a top dressing to the plowed land and then disked in. It is therefore necessary to mix the material with the soil as thoroughly as practicable. Under farm conditions it would seem that this is best accomplished by spreading somewhat more than half of the

amount on the surface, plowing it under as deeply as possible, and then adding the remainder and disking it thoroughly. This method was found most successful on the test plots.

A more uniform distribution can be obtained with a fertilizer spreader, and as a uniform distribution is very important, the use of one is strongly recommended. In some cases when the land was not plowed as deeply as desired, the practice of following the plow with a bucket of cyanamid and sprinkling the material in the bottom of the furrow was resorted to. On a small garden plot it is practical to have the cyanamid hoed or spaded in, thus securing a more even distribution.

It is best to choose a dry period for the application of cyanamid, as the material will mix better with dry earth. In wet ground lumps tend to form, as the material absorbs water readily. If stored for some months, particularly during the rainy reason, cyanamid absorbs water from the air and forms hard lumps. These must be broken before the material can be used. All cyanamid used should be sufficiently fine to pass through an 18-mesh wire mosquito-screen. Chunks of the material added to the soil not only are useless for killing nematodes, but they remain in the soil for a long time before they entirely disintegrate, and have a very harmful effect on subsequent plant growth. When fresh, the material is a very fine powder which works well.

IRRIGATE THE FIELD.

When cyanamid has been thoroughly mixed with the soil, the field should be at once irrigated. Enough water should be used to wet the soil thoroughly to the depth ordinarily reached by nematodes, which is 15 or 18 inches in the usual loose sandy soils of our State, or to ground water. Although the greater number of worms is in the first 8 or 9 inches of soil, it is necessary to kill the few below that depth, otherwise they will in a few weeks' time restock the upper layers of soil.

This thorough irrigation is very important for at least two reasons. It completes the distribution of the cyanamid begun by the plow and disk harrow so that more of the nematodes are reached and killed, and it hastens the decomposition of the cyanamid, shortening the time that must elapse before the crop can safely be planted. Although a heavy rain immediately after application is equivalent to an irrigation, the use of the cyanamid method of dealing with nematodes is not advised except on land that can be irrigated. One cannot safely depend upon the weather, and the material is too costly to lose.

COST.

At present, cyanamid retails for about $75 a ton. To this must be added the cost of application. This should, however, be but little higher than that for any other fertilizer. In estimating the cost one must take into consideration the value of the material as a fertilizer.

EFFECTS ON OTHER ORGANISMS IN THE SOIL.

Weeds. A striking difference is noticeable between treated and untreated plots in the amount of weeds that spring up. If plots are treated during the warmer part of the year, when seed are likely to germinate under the influence of the irrigation which follows the application of the cyanamid, practically all weeds, including most grasses, which have small seeds are killed. But large weed seeds like beggar-weed and coffee-weed are not always killed. Neither are the underground stems of Bermuda grass.

THE NITROGEN-FIXING BACTERIA.

Apparently these very valuable organisms will stand no larger doses of cyanamid than will the nematodes. At least on the plots that received cyanamid at the rate of a ton or more per acre, cowpeas were entirely devoid of nodules, while those on check plots had a normal supply. This may be due to the ammonia derived from the cyanamid rather than to the calcium cyanamide, as it is known that legumes grown in soil highly fertilized with ammonia may produce no nodules. It will probably be necessary to inoculate the seed if one wishes to reintroduce the nitrogen-fixing bacteria into treated soil.

MANUFACTURING PROGRESS IN LOUISIANA.*

At the annual meeting of the Louisiana Sugar Planters' Association, held on March 13, 1919, the Committee on Scientific Progress, consisting of Messrs. C. D. Kemper, W. L. Owen and L. H. Rayner, reported on the fifty-five replies to questionnaires sent out to the sugar houses of Louisiana. That part of the report dealing with the present-day manufacturing practices and factory inventory is herewith re-printed.

TRANSPORTATION OF CANE.

There does not seem to have been much change in the methods of transporting cane from field to the factory. There is no standard system as yet for unloading cane, although the tendency seems to be in the direction of cane grabs. A desire has been manifested on the part of the large plant owners and the railroads to adopt a standard system, so that one kind of crate can be used for all purposes, but owing to the numerous and various carrier-feeding devices a standard type is hardly attainable. There is no doubt that a universal car-racking system is a highly desirable line of progress in the problem of cane transportation. In Louisiana, cane is conveyed to factories by standard-gauge and narrow-gauge cars, by plantation carts, but no tractors are reported in use. We find that carrier-feeding devices are almost as numerous as the factories, indicating that each case has its own problem.

MILLING.

The washing of cane before crushing is a practice which has been put into operation in only a few of the factories. However, one factory which has been practicing this method for the past four or five years has been able to reduce the volume of filter-press mud 25 per cent. As filter-press mud usually carries away 6 per cent of sucrose, the saving from cane washing is considerable. The cane washers now in use in the State are of very simple construction. They consist of a sloping-bottom dip pan blocked to the bottom of the cane carrier just at the foot of the incline. The pan should be about 50 feet long. The spray can be made from a 2½-inch tee with hack-saw holes in its back and set just centrally over the carrier so as to put the water equally all over the cane. Hot water from the sweet water pump serves the purpose well. The water being quite hot, the cane usually dries almost completely before reaching the mill.

Evolution in Mill Design. While one factory is reported to have recently installed a twelve-roller mill and a crusher, the tendency in the factories seems to be toward the nine rolls and crusher. The Searby shredders in use at several of the factories in the State seem to be giving excellent results. Dr. C. E. Coates,

* The Louisiana Planter and Sugar Manufacturer, Vol. LXII, No. 12, March 22, 1919.

who has recently made an extensive survey of the question of type of mills in use in Louisiana, and whose report was recently published in *The Louisiana Planter,* advocates a milling plant composed of a crusher followed by a shredder, and this followed by a nine-roller mill. Double crushing as introduced in Cuba, does not seem to have received any attention in Louisiana. The deep grooving of mills, however, is coming in for a good share of attention. Where it has been tried it has given increases in extraction amounting to as much as 1½ per cent. The grooving of mills has a twofold advantage—it insures better extraction and lessens reabsorption of the juice since it affords a better way for it to escape.

Bagasse moisture varies according to the answers in the questionnaires all the way from 22 to 55. Bagasse moisture is known to be relatively higher in Louisiana than in Cuba, and it usually is supposed to be about 49-55 as compared with 45-48 in Cuba. This difference is not entirely due to higher mill extractions in Cuba, but in a large measure due to the fact that the fiber of the Louisiana cane is softer and more spongy and is, therefore, more liable to re-absorb juice from the film on the rolls. It would seem, therefore, that grooving of mill rolls would be well calculated to yield excellent results under Louisiana conditions.

Permanent progress in any manufacturing industry depends on the amount of thought that is directed towards overcoming the sources of waste incident to the manufacturing process. It would seem inconsistent with progress, therefore, for the sugar manufacturer not to have any means of more than approximately estimating the amount of juice that comprises the raw material for his factory. Yet out of the questionnaires received, only 32 per cent reported either the measuring or the weighing of juice. Twenty-three per cent measured the juice and 9 per cent weighed it.

The same variation in means of estimating the amount of juices entering the factory is observed in the method of applying maceration water. Here the amount varies from 6-23 per cent. The average seems to be about 15 per cent. In some factories the juice from the last mill is used to macerate the cane between the first and second mills, thus avoiding the use of water and preventing so great a diluting effect on the juices. This practice is being abandoned owing to the chances for promoting infection. That losses from this source may be considerable is shown in a report from Java[1], where special investigation revealed a loss of 6 per cent of sucrose in juices during milling. Another practice about which much difference of opinion still

[1] Louisiana Planter, Vol. LXI, 327.

seems to exist is the relative advantages of hot and cold maceration water. There are some who claim that the advantage due to the greater facility with which hot water mixes with bagasse is more than offset by the greater amount of gummy matter that is washed from the cane. Here is another place where standardization is highly desirable.

The question of the pernicious effects of bagacillia has been very generally discussed during the recent years, and has resulted in universal agreement as to the desirability of keeping the clarified juices free from it. It was to have been expected, therefore, that the recognition of the dangers resulting from the presence of bagacillia in juices, might have led to some effort being made for its removal. However, if such effort in this direction has been made, it is not reflected in the replies to our questionnaires. Indeed, it would appear that in Louisiana the discussion has so far been a theory and not a belief. Evidently, the mills obtaining the highest extraction would likely have the most bagacillia to contend with, and, hence, have the greater need for facilities to remove it. As a matter of fact, however, we find nine-roller mills with juice strainers, with 100 holes per inch, and six-roller mills with strainers made of mesh with 600 holes per inch. There should be, it seems, a standardized size of mesh for strainers for mills obtaining various degrees of extraction.

POWER EQUIPMENT.

Of all the blocks contained in the questionnaire this was answered least satisfactorily. For example, the question was asked: "Of what does your boiler plant consist?" The purpose of this question was to ascertain the ratio of boiler power to mill capacity. Our ultimate object was to determine what efforts are being made to make the most efficient use of bagasse as a free fuel. In few cases was the boiler horsepower given, nor were we enlightened as to the types of boilers used, whether natural draft or blowers were required, or whether grates were stationary or shaker. It would have been of value, too, to have been able to have elicited the information as to the number of water-tube and of fire-tube boilers in use in the sugar factories of the State. In the evolution of bagasse burners we find today one square foot of grate area to every 16-horsepower of boiler, while eight years ago some of the up-to-date furnaces were designed with one square foot of grate to every 10-horsepower of boiler.

Very large variations also exist in the amount of bagasse consumed per square foot of grate area. This variation is all the

way from the bagasse from 4 tons of cane, to that from 18 tons, being burned per square foot of grate. Undoubtedly the greatest improvement of the past year in sugar-house equipment in the State has been in the boiler rooms. Our question as to oil consumption per ton of cane showed that in 80 per cent of the houses the oil consumption was over 5 gallons. Seven gallons of oil per ton of cane may be considered fairly efficient where plantation granulated is being manufactured.

CLARIFICATION.

There has not been much change in methods of clarification, but here, as elsewhere, there is the greatest variation in how the same method of clarification is handled. For example, on the question of heating of juice in clarification, we find temperatures ranging from 180 to 240. The cases where the temperatures above 200 were used were 62 per cent of the total, and in every instance they agree that a quicker and better precipitation was obtained. Only two cases were reported of houses using juice heaters, where temperatures under 200 degrees F. were found to give better results than were obtained with the higher temperatures. One house that kept a record on juice heating on 500 square foot return current juice heaters, using large cone-bottom settlers with 60 degrees angle bottom, with capacity enough to give three hours' settling (which is a fair basis to work on) could easily settle out all the impurities and give a light sparkling overflow by using temperatures from 180 to 200 degrees F. This shows that with the proper amount of juice heaters and with the necessary settling capacity, juices can be properly clarified with low pressure (exhaust) steam. Furthermore, the scale formation at these temperatures is more easily removed than that formed at more elevated temperatures. Among the questions asked under the head of clarification was the following: "Do you have enough exhaust to heat juices properly?" The purpose of this question was to determine from the answers from factories using clarifiers and return-current heaters and from those using heaters and settlers, which of these two installations was the more economical. There are some who advocate temperatures of from 180 to 210 for juices, claiming that at this temperature the impurities are coagulated while higher temperatures dissolve many of these substances that could have been removed at the lower temperature. We find in our answers that fuel economy seems to have been left out of consideration in the selection of this part of factory installation. Obviously here is another place where standardization would prove profitable.

On sulphuring and liming we also find the greatest amount of variation. In the majority of cases we find sulphur boxes being used; that is, a large square box with shelves perforated on which to spray the juices. In other cases the sulphur fumes are taken into the suction of a pump, running over speed. In still other cases we find that the sulphur fumes are injected directly into the juices. Each of these methods has its advantages and disadvantages. The sulphur boxes are inaccessible and difficult to clean, and more difficult to maintain in that condition. The use of sulphur fumes in the pump is one of the simplest means of sulphuring; however, it is rather severe on the pump. The committee was asked, through one questionnaire, for an expression of opinion as to what harmful effect can result from sulphur fumes being forced into sulphur boxes with steam jets. It is generally admitted that steam can be used to good advantage for this purpose if it is applied behind the point of combustion, thus decreasing the possibility of forming sulphuric acid.

With liming as with sulphuring of juices we find no one system of operation. To the question of how do you apply your lime, paste, liquid, or in pump, we received various replies. From these replies we find liming done in every conceivable way from the use of a very thick paste in some instances to that of a thin 10-degree Baumé solution in others. In some cases the dry hydrate is even used. It is now generally conceded in the sugar industry that liming is most efficiently carried out by the continuous process in a pump, the final addition being made in liming tanks equipped with agitators.

In only few cases was there reported in the replies to our questionnaires any measures being taken to control lime salts. We find that there is a tendency throughout the State to replace clarifiers with settling tanks, and there are many different styles of settlers now being used.

With regard to methods of clarification in the sugar factories of Louisiana we may conclude from the questionnaires received, that but little progress has been made. Standardization is greatly needed in this department of the manufacturing process. Moreover, its attainment involves the least of difficulty or uncertainty as to increase in efficiency.

There is one phase of clarification which demands some comment before passing over to the next topic of the questionnaires. The question of whether or not the sulphuring of syrup is being practiced showed by the replies that this is done in rare instances. One factory, however, reports excellent results from this practice. In this case the juice is given a slight addition of sulphur, after clarification and just before it is taken into the pans.

FILTRATION.

It is now generally conceded by sugar manufacturers in Louisiana that all juices should be filtered whether 96-test or plantation granulated sugar is being made. There has been, according to Dr. Coates' report, a number of installations of bag filters in various factories throughout the State, during the past season. These, for the most part, are the Greenwood type with removable head. At Meeker an excelsior filter was used with gratifying results. Attempts to install Sweetland or Kelly presses came in conflict with war conditions and had to be postponed. Although the bag, and plate and frame presses are the type commonly found in the Louisiana factories one of the largest factories in the State has been using sand filters for a number of years with excellent results. They are circular filters about 6 feet deep. The direction of the influent juice is down through a 3-foot bed of white sand and about 10 inches of gravel sand to the effluent juice strainer heads. The process of cleaning is simple and rapid and is reversedly from filtering the cleaning water being hot sweet waters from the effects. The water is forced upward through the strainer heads with a centrifugal pump. The pressure of water keeps the sand grains in suspension and they are easily freed from the coating of mud and impurities. The operation of cleaning is all done by one man and a helper in about 20 minutes. Owing to the economy incident to the elimination of the necessity of buying filter bags, as filter cloths are now quite an item of expense in a sugar factory, the sand filter is an interesting possibility. The centrifugal filter has not yet won a place in the sugar industry. However, some interesting experiments have been made, an account of which will be given in a subsequent part of this report. The filtration of syrups is a very difficult problem. At one time there was one house in the State where all syrups were filtered. The density at which they filtered was about 23 degrees Baumé. The settling of syrup is generally regarded as a highly important adjunct to clarification. From the replies to the questionnaires, however, one would judge that it is only an incidental practice. In the first place no specially constructed tanks are in general use for this purpose, and tank capacity rather than design seems to be considered the criterion. There is also quite a wide difference in the density at which syrup is settled. This varies from 22 to 30 Baumé, which would indicate a considerable difference of opinion as to the exact density at which syrups can be most efficiently settled. The settling of syrup can not only be carried out more rapidly in

tanks with sloping walls, but tanks of this type of construction can be drained out much more completely, thereby involving less waste in wash waters.

EVAPORATION.

In looking over the questionnaires one is most impressed with the variation in evaporating equipment and evaporating practices. Under this head we find the greatest lack of standardization. Evaporators of all kinds are in use. Effects can be subdivided into two general types, viz.: film evaporators, and submerged tube evaporators. The latter class can be still further subdivided into vertical and horizontal tube types. These in turn can be classified according to the number of their units, viz.: double, triple, quadruple, etc. In many factories, the apparatus that was first installed has become obsolete, but still remains in use although additions in many instances have been made of newer units. Two or more small units are used, where one large unit would be more economical. A few Kestner film type evaporators have been installed. In many houses the effects are obviously overloaded, and losses from entrainment are correspondingly heavy. This is a source of loss which has not yet received the attention that it warrants.

The lack of standardization in type of evaporators in use, applies also to the matter of density at which syrups are delivered to the pan. This ranges all the way from 20 to 33 Baumé. We know that there are disadvantages in delivering syrup to the pan at a high density. If the density is over 30 Baumé the effects will get the full influence of scale-forming matter, and will speedily slow down on that account. On the other hand, if the density is too low, the demands upon the pan will be excessive, and result in a high fuel consumption. Obviously this is a point requiring a careful adjustment in order to get best results. It is the opinion of your committee that under normal conditions a density of 25 Baumé is the most desirable. That this very variation in density of the syrup delivered to the pan is reflected in the frequency with which the effects have to be cleaned in various factories, seems most probable. The frequency of cleaning effects we find to vary from every 3 to 4 days to only once or twice per season. In most cases the effects are cleaned out once a week by the use of acid preceded by soda.

Often the house is crowded for time and this cleaning process is postponed until the cleaning becomes a vital necessity. In one of the houses in which the effects are boiled but once or twice a season, the lime salts are controlled by the use of soda ash by

means of which the objectionable scale is kept at a minimum. They do not carry the density of syrup beyond 26 Baumé in the last effect; they filter all the juices carefully and use a perforated coil for steam agitation.

We recognize in these provisions an intelligently directed effort to prevent scale formation. In the recent report by Dr. Coates, to which we have already several times referred, he discusses, at some length, the inefficiency in evaporation in effects due to scale formation. He claims that this matter is commanding more attention in sugar factories in Louisiana than it formerly received.

PAN WORK.

We gather from the questionnaires that the average pan capacity is 15 cubic feet per ton of cane. This appears to be less than will be required unless seconds and thirds are made. The use of slow boiling, low pressure pans seems not to be receiving the attention that it should demand.

We find various steam pressures carried at the pan in different houses. The pans vary from 8 to 14 feet.

The steam pressures vary from 50 to 100 pounds. The temperatures of graining are anywhere from 140 to 170 for first sugars. There are calandria pans, coil pans, crystallizers, hot-room cars, and magma tanks in use in the crystallizing department of factory work. Close observers of vacuum-pan work agree that there is an exact temperature at which graining can best be effected. On low-grade sugars a temperature of 140 seems to represent the consensus of opinion as to what is required. The graining of sugar is a matter requiring the greatest possible attention even on raw sugars. This committee recommends a closer study being made to standardize if possible this department of the manufacture of plantation sugars.

The cleaning of pans offers the same problems as the cleaning of the effects, the only exception being that, since most houses have several pan units, one can be thrown out of commission long enough to clean it without causing a loss of mill time. Only four factories had ever tried seeding. Some confusion, however, seemed to have existed in the minds of those replying to this question. Not a few seemed to have regarded seeding as synonymous with the practice of cut strikes. Seeding, as carried on in Cuban sugar houses, consists in graining on some dry material which is usually grains from a lower massecuite. These grains are mixed with a syrup and kept in a special storage tank. When a pan is about to start this seed is taken into the pan, as is done with cut-over strikes. The rest of the process is carried on as in

an ordinary strike of grained sugar. It is claimed for this method that it is not only more rapid than the ordinary way of graining, but that the grains are much more easily washed on account of their better structure.

However, so far as we know, it is being used at the present time in only one factory in the State, viz., at Glenwild. We hope to obtain from Messrs. Pharr a full report for later publication, on the success with which they have employed this method of graining.

It would seem that this method might be used to great advantage in Louisiana for raw sugar manufacture.

To the question of what the sugar-drying equipment consists, few replies were received.

The purpose of this question was to determine the number and kind of centrifugals used, the method of charging and discharging them, and manner of separating run-offs. Of course, this operation is not very necessary except when making white sugar. In only a few cases was this question answered.

The questionnaires showed that in few houses has double purging been tried. The object of this practice is to get the greatest amount of low sugar out of the least number of boilings. The process requires two sets of centrifugals. The first set turning at rather low speed, the sugar from this machine is discharged only partly dried. The run-off from this sugar is low. The partly dried sugar is then conveyed to a mixer, from which it is drawn into a centrifugal going at a high rate of speed. The run-offs from the two sets of centrifugals are kept separate.

SUGAR DRYING AND GRANULATION.

We have already discussed the first part of this group of questions in the preceding paragraph.

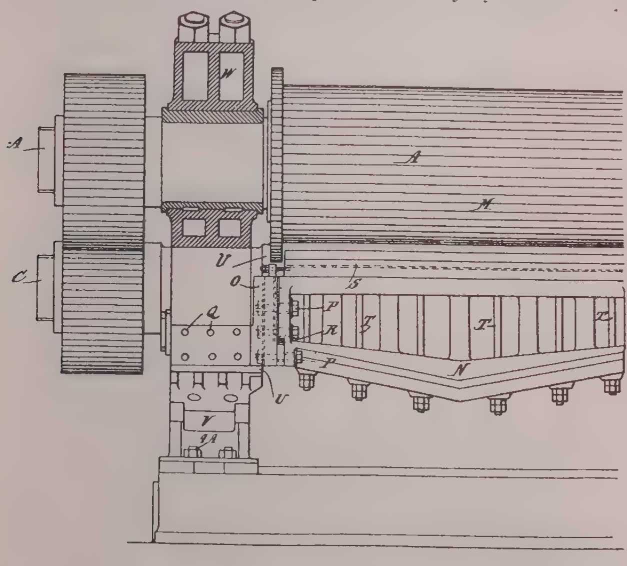
The answer to our question as to the types of granulators now in use in Louisiana factories showed that there are four principally used at present. These are the Harry Bros., Louisville, the Dill, and Hersey. We find that but scant attention was given our question as to the temperatures carried on sugar granulators. And yet this is obviously a very important matter. Too high temperatures makes the corners of the sugar grains brittle, as a result of which they break very easily when rubbed against the walls of the machine. This results not only in an accumulation of sugar dust, but also in a decrease in the luster of the grains themselves.

Some authorities on granulators recommend a large deposit room for collecting this sugar dust. Others recommend dust col-

lectors made on the principle of a centrifugal which recovers the particles of sugar floating in the air, and on the sides of the machine. These collectors have a long conical bottom with a short section of discharge pipe set into a tank of water. The most practical way of handling sugar dust is to melt it. We have previously mentioned the fact that sections VIII and IX, on Handling of Run Offs, and Source of Manufacturing Water, were very indifferently answered. The replies to these questions are so incomplete that it is hardly worth while to comment upon them. However, your committee, nevertheless, desires to register its recognition of the importance of using a good source of water supply, not only in the centrifugals for washing sugars, but throughout the entire house. [W. R. M.]

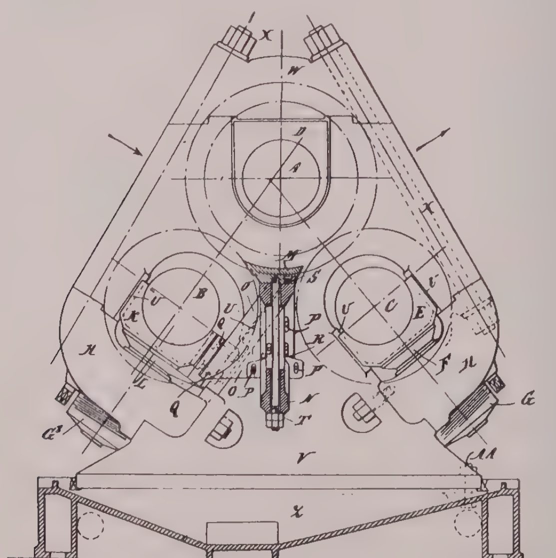
A NEW CANE MILL.*

We illustrate herewith a new sugar cane mill, invented by Mr. A. J. Cos, a Hollander, but now of Tirlemont, Belgium, who has assigned the patent to the corporation of J. J. Gilain at Tirle-



* Louisiana Planter, March 1, 1919.

mont. The United States patent was issued December 31, 1918, and the distinguishing feature of the cane mill is that the turn plate between the bottom two rollers of the ordinary three-roller mill is attached to the front roller in such a way as to maintain close contact with the front roller, the top roller being held down rigidly and the hydraulics being applied to the receiving and discharging rollers. The connection of the turn plate with the receiving roller is such that while the receiving roller will move outward and backward from the mill center, the turn-plate travels with it and the roller having a hydraulic attachment where in the old-fashioned mills set screws are applied in the caps, the



hydraulic, with whatever pressure may be determined, maintains the pressure on the receiving roll and also on the discharging roll so that the bottom two rolls are each held up with full hydraulic pressure to the rigidly adjusted top roll and it is believed that in this way better results can be obtained in mill pressure than in mills wherein the top roller only responds to the hydraulic pressure, leaving unequal pressures for the receiving and discharging rollers. The patentee of the mill evidently believes, and we think our own experience justifies us in accepting the inventor's judgment as accurate, that there is a lack of uniformity in the cane feeding that would make it desirable to have

the full mill pressure on each roller all the time that the mill is at work, whereas, under the common method of applying hydraulic pressure, each individual three-roller mill will have but the one pressure and yet the feed of sugar cane between the receiving roller and the top roller utilizes the pressure and while so utilizing the full pressure the discharging roller for some seconds may do less than its expected work. With hydraulics applied to the two rollers and with the turn-plate so made as to follow in the receding movement of the first roller, it would seem that certainly better work can be done than with the single pressure on the top roller. This is the gist of the invention, and our sugar engineers can readily see how the work is done by the accompanying illustrations. [W. R. M.]

"WHAT IS A DOLLAR'S WORTH OF FERTILIZER?"*

"What is a dollar's worth of fertilizer? Can the class in arithmetic answer? All right, Johnny."

"Please, sir, it's the number of pounds in a ton divided by the number of dollars it costs."

"Ah, Johnny, that tells us how much it costs; now tell the class how much it is worth."

"Please, sir, it's a dollar's worth."

"Ah, ah! It's worth what it costs, that's fine, and it's simple, too—some advantage in that!

"Now, Johnny, supposing that one fertilizer costs $25 per ton and another fertilizer costs $40 per ton—that is, a dollar will buy eighty pounds of one, fifty pounds of another; what is a dollar's worth?"

"Please, sir, there ain't any such animal. Who ever heard of anybody buying a dollar's worth of fertilizer?"

But the answer to this question is not so difficult as it seems, when certain essential factors are considered.

Buying of familiar articles is largely a matter of habit; for, regardless of the particular brand we select or accept, there is a fixed idea, precedent or standard, that is applied to the purchase, consciously or unconsciously.

In the old days "before the war" we asked the grocer for a

* By O. B. Briggs, in The Country Gentleman, reprinted in The American Fertilizer, No. 5, March 1, 1919.

dollar's worth of sugar, knowing that we would get about sixteen or seventeen pounds for our dollar. This was a habit of convenience and there was nothing wrong with it, so long as the sugar didn't resemble too much the common variety of beach sand.

A pound of meat, a barrel of flour, a loaf of bread, or a cord of wood is a simple purchase, and anyone familiar with these things can be reasonably sure of getting his dollar's worth.

On the other hand, a bushel of corn is not a bushel unless it weighs a bushel; a quart of cream is not just cream, it is butter fat; and even "a ton of coal" loses its significance when the large manufacturing plant insists on testing the coal for heat units.

Briefly, it may be said that a dollar's worth of fertilizer is the largest amount of fertility or crop-producing power that can be bought for a dollar.

With the prospect that fertilizer prices cannot be expected to reach pre-war levels for years, it is important that buying should be done as wisely as possible.

The manufacturers are not scoundrels—State laws prevent them from defrauding the farmers, even should they be so inclined. But no law has yet been devised to prevent a man from defrauding himself by unwise buying. With the best of intentions we will sometimes cheat ourselves, however sharp we ordinarily would be in a deal.

The farmer who wants to buy fertilizers cheap but does not understand fertilizer values, will probably pay a high price for actual fertility.

Fertilizer-buying habits may be roughly represented by three classes of buyers:

First, those who buy by the ton—the price being the main consideration.

Second, those who think they know what grade is suited to their purpose, and shop for the best price.

Third, those who by long experience with a special crop are convinced that a certain high-grade analysis is best suited and most profitable, and buy at the best price consistent with the reputation of the manufacturer for quality and service.

The first class is entirely wrong.

The second class is more than half wrong.

The third class is fundamentally right, but may be wrong to the extent that the idea may be improved upon.

To the first class belongs the man who buys fourteen per cent acid phosphate because it is the cheapest per ton that he can

find, and buys it in preference to sixteen per cent acid phosphate because it costs $1.50 per ton less. Acid phosphate, without a doubt, has its proper place; and when phosphoric acid alone is required for balancing an application of manure or other suitable purposes it is an economical source of phosphoric acid. But when it is used simply because it is cheap it may prove expensive when the harvest is done.

A 1-7-1* fertilizer is really low grade, but it meets with favor with certain buyers because it is a complete fertilizer and is sold at a comparatively low price.

If we assume that the proportion of phosphoric acid to ammonia and potash is all right in this analysis—we will say for wheat—the question is whether the grade itself is economical to buy.

A 2-14-2 has the plant food in exactly the same proportion as 1-7-1, and 300 pounds per acre of 2-14-2 are equal to 600 pounds per acre of 1-7-1:

	Application per Acre, Pounds	Pounds of Plant Food per Acre		
		Ammonia	Avail. P. A.	Potash
1-7-1	600	6	42	6
2-14-2	300	6	42	6

In other words, it takes two tons of 1-7-1 to equal one ton of 2-14-2. When you consider that the per ton cost of manufacturing—that is, handling the materials, batching, curing, storing, bagging, bags, loading, freight and hauling—is the same with both analyses, it is not difficult to see the saving in buying the more concentrated mixture. This saving would amount to $15 per ton under present conditions.

ONE TON BETTER THAN TWO.

A 2-8-2 fertilizer is not low grade, but it meets with favor where a complete fertilizer of medium price is desired.

If we assume that the proportion of the elements is right for corn, the question is whether the fertility can be bought more economically.

A 3-12-3 has the plant food in exactly the same proportion as 2-8-2. Three hundred and fifty pounds of 3-12-3 is equal to 525 pounds of 2-8-2.

* 1-7-1 means 1% ammonia, 7% phosphoric acid and 1% potash.—Editor.

	Application per Acre, Pounds	Pounds of Plant Food per Acre		
		Ammonia	Avail. P. A.	Potash
2-8-2	525	10½	42	10½
3-12-3	350	10½	42	10½

It takes one and a half tons of 2-8-2 to equal one ton of 3-12-3, and the saving in this instance under present conditions is about $8 per ton by buying the 3-12-3.

A 3-8-5 is a high-grade fertilizer suitable for truck. Is there any possibility of saving on a high-grade brand such as this?

A 4-10-6 has the plant food in practically the same proportion as 3-8-5. It takes 1500 pounds of 3-8-5 to supply approximately the same plant food as 1200 pounds of 4-10-6.

	Application per Acre, Pounds	Pounds of Plant Food per Acre		
		Ammonia	Avail. P. A.	Potash
3-8-5	1500	45	120	75
4-10-6	1200	48	120	75

It takes one and a quarter tons of 3-8-5 to equal one ton of 4-10-6, or a saving at present costs of about $3.50 per ton by buying the 4-10-6.

The point to be remembered is that the expense of manufacturing, handling, bags, freight and hauling is the same per ton, regardless of the plant food contained, and that the fertilizer buyer can save money in proportion as the weight is reduced by concentrating the plant food.

A dollar's worth of fertilizer is the largest amount of actual fertility or plant food that can be bought for a dollar.

[J. A. V.]